VISUAL STRUCTURAL APPRAISAL

Boulton House
Spoon Lane
Tipton
B70 6BJ

24th June 2025

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

Document Issue

Revision	Date	Purpose of Issue
A	24.06.25	Issued for Review

Prepared By

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Dated: 24/06/2025

Reviewed by

Firntec Project Consultant

Dated: 24/06/2025

Competency Statement

Ruben has a thorough range of experience on projects both in the UK and globally, centered on the construction industry but also in public art installations and bespoke structures. His extensive experience in a wide range of projects afford him the contacts to bring together the right team for a job. Ruben has worked on a range of projects where he has developed the ability to perform conceptual and detailed designs, analysis of complex structures and element design. He has extensive experience in structural design and construction methods and has successfully completed projects with values in excess of £10m.

Ruben has also been engaged in structural appraisals of high rise residential structures across the UK and has been assisting Principal Accountable Persons in assessing their housing stocks and compiling information to be included in the golden thread as a requirement of the Building Safety Act.

QUALIFICATIONS, MEMBERSHIPS & TRAINING

First Class MEng Civil Engineering - University College London

Chartered Engineer and Member - Institute of Structural Engineers CEng MIStructE

Knowledge of the Engineering Council's competency register for HRB's as set out in UK-SPEC for HRB

Continued professional and development through industry led courses and webinars on The Building Safety Act, fire in structural engineering and assessments of existing HRB's.

Contents

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

1. Executive Summary

The building survey revealed that the overall structural integrity of the property is sound. No major structural issues were identified that pose an immediate threat to the occupants or the building's stability.

Is the Building Safe to Occupy?	Yes

However, some intrusive investigations are required to properly assess the building's health, condition and fire resistance. The actions for the building are:

Ref no	Observations/Actions	Risk Rating	Mitigation	Timescale
Boulton 001/ 2025	Concrete material tests for strength, cover depth, carbonation, presence of chlorides and HAC. Balcony assessment also required	Medium	Engage a qualified specialist contractor to complete the investigations	within the next 24 months
Boulton 002/ 2025	We assume there is a suitable tie between the inner and out leaf of cavity wall façade however this can't be confirmed without further investigations.	Low / Medium	Engage a specialist contractor to check the façade brickwork including an endoscope survey to inspect type/condition of wall ties.	Within next 24 months or sooner if the building is called in by the BSR
Boulton 003/ 2025	Regular maintenance is crucial to preserving the property's condition and preventing future issues. The building is to be surveyed at regular 5 year intervals to inspect for signs of movement, structural decay and/or defects.	Low	Engage a qualified specialist contractor to complete the surveys	Every 5 years

Refer to HAZID risk assessment in Appendix B for detail.

2. Introduction

2.1.Brief

Firntec were appointed by Sandwell to perform a visual structural appraisal of the purpose built residential block known as Boulton House, B70 6BJ. The instruction was to identify the key structural elements of the building and is prepared to be included as part of the Building Safety Case Report for the housing block. The inspection relates to the main building only and any external fences/walls, sheds and outbuildings/garages have been excluded from our scope. An inspection of the property was undertaken by Firntec on the 5th June 2025. The scope of the inspection included limited, visual observations of the interior and exterior of the structure. The inspection was limited to accessible areas which included the external elevations (viewed from the ground), communal areas, stair core, plant rooms and the roof.

Figure 1: Site location

2.2 Limitations

This report is based upon a visual inspection of the property, as described above. This report describes the findings and draws conclusions of a general nature and is not an intrusive survey of the building and no calculations were carried out with regards to load transfer and verification of structural members.

Whilst comments are made to satisfy the requirements of the brief, the report has, of necessity, not been exhaustive and cannot therefore constitute a warranty as to the soundness or otherwise of the property in areas hidden from visual inspection or not seen during the inspection.

No internal finishes were disturbed during our inspection, and no opening up works or invasive inspections were undertaken. We were not able to observe any structural elements where hidden under finishes.

This report has been prepared for the sole use of the client Sandwell.

Disassembly or removal of any portion of the structure, mechanical equipment, plumbing equipment, or electrical equipment is beyond the scope of this inspection. There is no warranty or guarantee, either expressed or implied, regarding future performance, life, insurability, merchantability, workmanship, and/or need for repair of any item inspected.

Please note that any liabilities associated with Asbestos including surveys, identification and removal have been excluded.

The components of the property included in the scope of the inspection, if present and applicable, include: structural foundations, primary load-carrying framing members, roof surface, façade structure, and miscellaneous items related to the property. The scope of the inspection is specifically in relation to structural elements and hence general building defects which are not structurally significant may not be included.

2.3 Survey Methodology

Initially a desk top study was completed through research of online records and available archive information. The desk study considers site-specific historical, geological and environmental characteristics such as the expected soils condition and if the site is within a flood zone. It also includes a review of the existing available information provided by the client. From this we are able to determine the expected construction type and materials used and plan the survey accordingly.

Once the nature of the site and surrounding areas has been recorded the more detailed inspection of the building can take place. This includes an appraisal from the inside and outside of the building. A visual appraisal is completed on every level with a more detailed assessment completed at intermittent floors, always including roof level, top floor and ground floor.

If archive drawings are unavailable the structural form of the building is determined by searching for the areas where the underlying structure is visible such as plant rooms, bin stores or service cupboards.

The integrity of the building is assessed searching for signs of structural movement, material decay and inspecting the condition of the structural elements. Below is a list of completed actions for each area inspected:

ACTION	POINTS CONSIDERED
INSPECT ROOF AREA	• Check for signs of cracking at junctions • Check levels • Check for obvious defects
CHECK FINISHES IN FLAT/COMMUNAL AREAS	• Review each area for damages to finishes which may be caused by structural movement
SEARCH FOR CRACKS IN STRUCTURE	• Search for cracks in structure, in particular at junctions between elements • Are cracks penetrating structure • Follow the trail of the crack to assess cause
CHECK FLOOR/CEILING LEVEL	• Sagging ceiling or unlevel floors may indicate deficient design or overloaded floor plates
INSPECT CUPBOARDS	• Inside cupboards underlying structure often visible • Finishes may not have been updated and therefore provide insight into original features
ASSESS CLADDING FIXINGS	• Search for access to view cavity • Search for defects of failed wall ties such as bulging walls, cracking and separation of window reveals • Check for lifting/sagging of lintels

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

CHECK OPERATION OF DOORS/WINDOWS	• Search for windows and doors which are out of square, binding, cracks in the architraves
SEARCH FOR MATERIAL DEFECTS	• Identify materials used and known issues with material
INSPECT PLANT ROOMS AND SERVCE ROOMS	• Areas often without finishes revealing underlying structure • Often structural form and key elements visible
INSPECT EACH ELEVATION EXTERNALLY	• Search for cracks and/or signs of structural movement
IDENTIFY OVERHANG STRUCTURES	• Search for overhang structures • Inspect for visible defects
ASSESS STAIR CORE	• Often shear core providing stability • Stair form (precast/in-situ)
INSPECT GROUND FLOOR	• Search for vents to determine if floor is ventilated / suspended • Check levels

Table 1: Site Survey Actions

Reference shall be made to Table A of BRE Digest 292 "Cracking in Buildings" 2nd Edition (2016)

Table A: Classification of damage and repair for different crack widths

Category of damage	Description of typical damage (*Ease of repair in italics*)	Approximate crack width
0	Hairline cracks of less than about 0.1 mm width are classed as negligible.	Up to 0.1 mm
1	Perhaps isolated slight fracturing in building. Cracks rarely visible in external brickwork. *Fine cracks of up to 1 mm width can be treated easily using normal decoration.*	Up to 1 mm
2	Cracks not necessarily visible externally. Cracks can be filled easily. *Redecoration probably required. Recurrent cracks can be masked by suitable linings.* Some distortion to doors and windows, which may stick slightly. *Some external repointing may be required to ensure weathertightness.*	Up to 5 mm
3	Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired. *The cracks will require some opening up and can be patched by a mason. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.*	5–15 mm or several, each up to 3 mm
4	Window and door frames distorted, floor sloping noticeably*. Walls leaning or bulging noticeably*. Some loss of bearing in beams. Service pipes disrupted. *Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.*	15–25 mm, depending on number
5	Beams losing bearing, walls leaning badly and requiring shoring. Windows broken with distortion. Danger of instability. *This requires a major repair, involving partial or complete rebuilding.*	Usually greater than 25 mm, depending on number

* Local deviation of slope, from the horizontal or vertical, of more than 1 in 100 will normally be clearly visible. Overall deviations in excess of 1 in 150 are undesirable.

Table 2 – BRE Digest 292 Table A

2.4 Potential Material Defects

Material defects in concrete and brickwork buildings can have various causes and can affect different components of the structure. Here's a list of common material defects in concrete and brickwork buildings:

<u>Concrete Defects:</u>

1. Honeycombing: Incomplete filling of the concrete mix, leading to voids or honeycomb-like structures within the concrete.

2. Cracks: These can occur due to various factors, such as shrinkage, settlement, overloading, temperature changes, or inadequate reinforcement.

3. Spalling: Concrete surface peeling or chipping off due to freeze-thaw cycles, corrosion of embedded reinforcement, or poor quality concrete.

4. Efflorescence: White, powdery deposits on the surface caused by the migration of soluble salts to the surface and their crystallization.

5. Alkali-Aggregate Reaction (AAR): Also known as "concrete cancer," it's a chemical reaction between alkaline cement paste and certain reactive aggregates, causing cracking and deterioration.

6. Corrosion of Reinforcement: Exposure to moisture and chloride ions can lead to corrosion of the steel reinforcement, weakening the structure.

7. Shrinkage Cracks: These cracks occur as the concrete dries and shrinks, especially if curing was not adequately done.

8. Carbonation: Carbon dioxide reacts with the alkaline compounds in concrete, lowering the pH and potentially affecting the passivation of steel reinforcement.

9. Presence of High Alumina Cement(HAC): HAC was widely used in the manufacture of structural pre-cast concrete in the 1960's as it accelerated curing. However HAC is found to be prone to a conversion process which could result in the concrete being reduced in strength.

Brickwork Defects:

1. Spalling: Similar to concrete, bricks can also spall or chip off due to freeze-thaw cycles, corrosion of embedded materials, or poor-quality bricks.

2. Efflorescence: As with concrete, bricks can also experience the migration of soluble salts to the surface, resulting in efflorescence.

3. Cracking: Bricks may crack due to structural movement, settling, or improper bonding.

4. Dampness: Bricks are porous, and excessive moisture penetration can lead to damp patches, staining, and deterioration.

5. Leaning or Bulging Walls: Improper construction, foundation issues, or lateral forces can cause brick walls to lean or bulge.

6. Mortar Joint Defects: Problems with the mortar used to bond bricks, such as inadequate strength, poor adhesion, or weathering.

It's important to note that these defects can vary in severity, and timely inspection, maintenance, and repairs are essential to ensure the safety and durability of concrete and brickwork buildings. As part of this survey we will inspecting for common signs of the above defects and in some cases may require further investigative works to determine their presence.

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

3 Desk Top Study

3.2 Existing Information

To date we have been provided with schematic floorplans for the building and a Fire Risk Assessment dated 6th December 2023.

We have not been provided with any existing calculations for the property.

3.3 Desktop Study: Ground Conditions

Our scope of works did not include intrusive ground investigations or soil testing. In absence of such data, we have undertaken a desktop study to identify the likely founding strata of the property. The British Geological Survey (BGS) produces maps which highlight the general ground conditions around Britain.

The bedrock is the 'Alveley Member' formed of Mudstone. Superficial deposits sit on the older deposits referred to as bedrock.

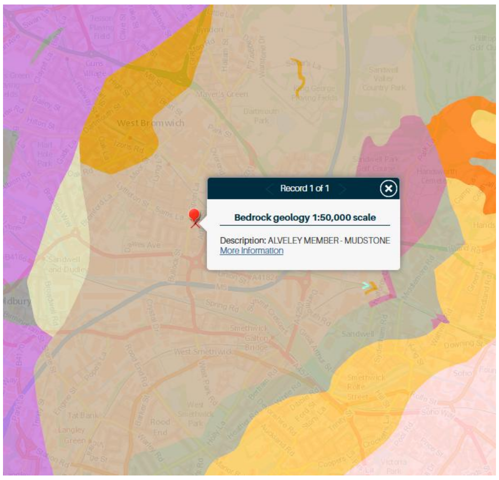


Figure 2. Bedrock Geology

For the site, 'Till' deposits are present.

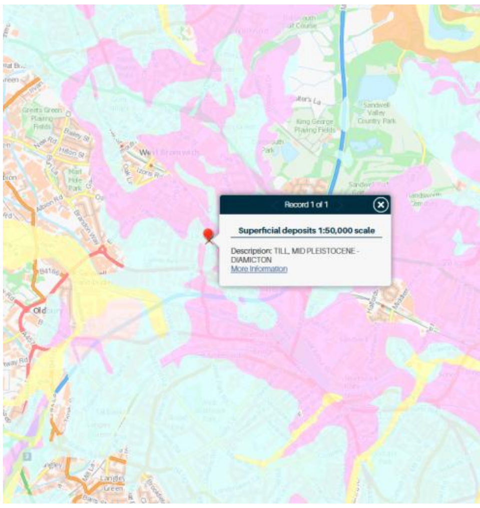


Figure 3. Superficial Geology

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

3.4 Desktop Study: Flood Zone .

Flood zones have been created by the Environment Agency (EA) as a starting point in determining how likely a location is to flood.

There are 3 flood zones as defined by the EA; Flood Zone 1, 2 and 3. The flood zones are based on the likelihood of an area subject to flooding, with Flood Zone 1 areas least likely to flood and Flood Zone 3 areas more likely to flood. The property is in Flood Zone 1 i.e. less than 0.1% chance of flooding from river or sea in any year.

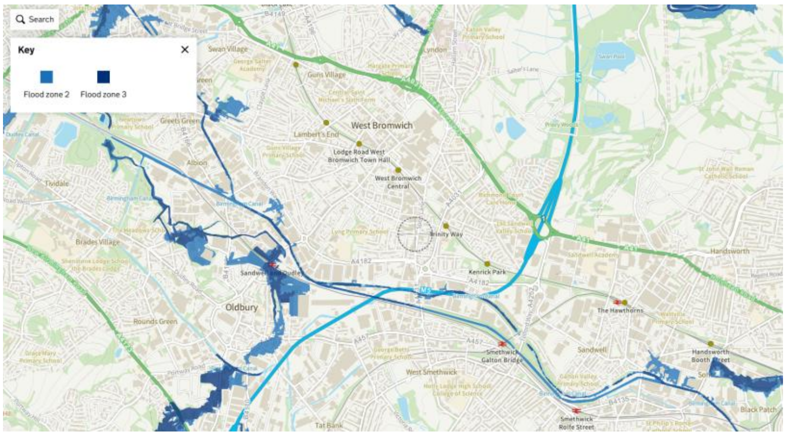


Figure 4. Flood Risk from Environmental Agency

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

4 Structural Form

4.1 Description of Building

The existing building is a 9 storey purpose built residential housing block containing 36 dwellings understood to be built in circa 1965 for West Bromwich Borough Council. The typical structure is constructed as a reinforced concrete frame which was cast in-situ with a RC slab supported off cast in-situ RC walls/columns which stack vertically throughout. The concrete beams and columns are at regular centres, and distributed evenly across the building. The typical floor slab was measured between 150-200mm thick.

Given the scale of the existing structure we would expect that the main foundation system is either a series of reinforced concrete pile caps and ground beams or a reinforced concrete raft foundation. Both of these systems will have reinforced concrete piles extending into the bedrock to a significant depth.

The fire resistance of the structural frame is provided by the concrete cover of the steel reinforcement elements. Due to the buildings year of construction it was likely built to CP114 and therefore the design fire resistance for the structure would have been a minimum of 1.5 hours. However the as-built cover is unknown and therefore the actual fire resistance requires confirmation with further investigations.

Vertically, the building is stabilised in two orthogonal directions by shear walls adjacent to the lift and stair cores and shear walls dividing the units. The in-situ floor slabs, which are effectively tied to the column heads, act as a diaphragm to provide horizontal stiffness.

The building has a flat roof with asphalt finish.

The typical floor plan of each storey is formed of a rectangular block with the cores placed centrally to the footprint. The staircase is in-situ reinforced concrete supported at each landing level and half landing level. The internal partition walls are unknown but presumed blockwork with masonry at ground floor.

The elevations are cavity walls with external leaf of stretcher bond masonry supported off the exposed slab edge.

Each floor has 4 cantilevering balconies in opposing corners of the block. These were not accessible however from inspection they have been cast as part of the main concrete slab.

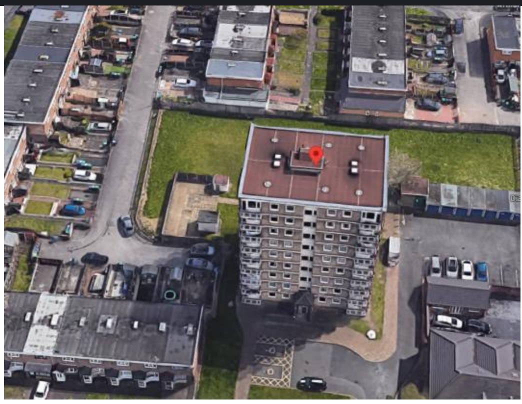


Figure 5. Aerial image of Boulton House

4.2 Structural Design Type

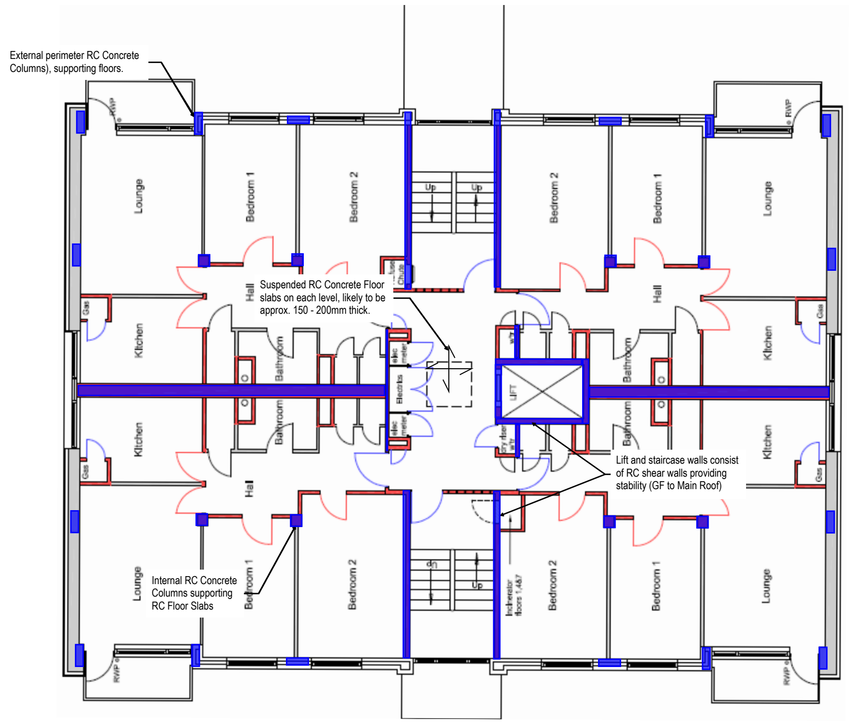
In order to comply with the Building Safety Act 2022 the block owner will need to register the structural type with the Building Safety Regulator. As part of the registration process the building material information is required which is indicated in Table 3.

Structure design type	
Composite steel and concrete	
Concrete large panel system - 1960's	
Concrete large panel system - 1970's onwards	
Modular - concrete	
Concrete - other	X
Lightweight metal structure (aluminium)	
Masonry	
Modular - steel	
Steel frame	
Modular - other material	
Modular Timber	
Timber	
None of these	

Table 3: Structure Design Type

4.3. Structural elements

Figures 6 indicates the assumed structural layout for a typical upper floor level.



RC Shear/Core Walls & Columns. Annotated on plan shown indicatively based on limited site observations and general floor plan arrangement. Likely other locations present where not shown on plan. All floors appear to align with minimum transfer structure present.

BOULTON HOUSE
TYPICAL FLOOR LAYOUT

Figure 6: Diagram of typical floor plan

Table 4 Below is a summary table of the key structural elements

Item	Notes
Original and Current design intent	The building is purpose-built for residential use.
Key Materials (Are there any Precast Concrete Elements)	The main structural material is concrete, internal block infill (non-load bearing walls), brickwork to external façade. Typology 5 structure
Design Loading Parameters	We assume that the building was designed to the current British Standard Code of Practice of the time which was: British Standard Code of Practice 3, Chapter V 1952: Imposed Loading Residential Floors = 40lb/ sqft (equivalent to 1.92kN/sqm) Flat Roof with access = 30lb / sqft (equivalent to 1.44kN/sqm) Stairs and Landings = 60lb/sqft (equivalent to 2.88kN/sqm) British Standard Code of Practice 114 1957 The structural use of normal reinforced concrete in buildings
Have there been any refurbishments	N/A
Primary Load Bearing System (Beams, columns, wall?)	Insitu Reinforced concrete frame construciton consisting of concrete walls and columns. The foundations were not exposed for the inspection, but are presumably deep piles.
Secondary Load Bearing System (floors)	Suspended in-situ reinforced concrete floor slabs.
Stability System - Horizontal and Vertical	The vertical stabilty is achieved via a mixture of RC Walls and Columns transmiting loads from each level to the foundations. The horizontal stability is achieved from the shear core walls/columns (lift/stair cores) with the concrete floors acting as a structural diaphragm.
Claddings and fixings	Brickwork to external elevations to all levels.
Roof Build-Up	Flat roof which consists of an RC concrete slab and insulated PIR/PUR board with felt roof coverings.
Description of any basements	N/A
Description of any cantilevered elements - Type(Juliet, cantilever, hung, stacked)	Cantilevered balconies at each floor level.
Fixing method for cantilevered element	Fixed to floor slab.
Cantilevered element structural and decorative materials	Handrails fixed to balcony floor.
Dimension Cantilevered element	1m
Current Structural Condition (Poor, fair, good, excellent)	Fair
Signs of structure not performing correctly (movement or failure)	None observed
Finishes in flat	No access to apartments
Structural Cracks Visible?	None observed
Floors and Wall Levels	Fairly level
Condition of Elevations	Fair

Table 4: Summary of Key Structural Elements

Figure 7 describes the load path for a RC framed building such as this. The loads distribute from the RC floor plates to the supporting load bearing RC walls/columns. The walls/columns are supported off the foundations which disperse the loads into the ground. The current foundation system is unknown but is presumed to be a reinforced concrete piled system.

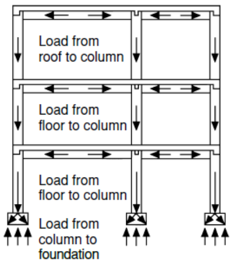


Figure 7 describes the vertical load path for the buildings

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

4.4 Robustness and Consequence Class

Avoiding disproportionate collapse is a critical concept for the design of new buildings and checking existing ones. It has to be accepted that explosions, usually gas, do occasionally occur and can cause severe damage to residential properties. Avoiding disproportionate collapse ensures that the structure of a building is designed or strengthened to ensure that damage is relatively limited.

The requirement was a consequence of the Ronan Point Large Panel System (LPS) building disaster of 1968. The Ronan Point enquiry produced recommendations (MHLG Circular 62/68) requiring all LPS blocks to be tied together. The initial recommendation referred to buildings with piped gas and required the structure to withstand a force of 34 kN/m^2. Another MKHG circular followed a few months later (71/68) which required a similar approach to buildings where gas was not supplied or had been removed but the pressure which the structure had to withstand was 17 kN/m^2.

The current building regulations (Part A – Structure) are regularly revised and include requirements for robustness to be included, specifically the horizontal tying requirement, to apply to all residential blocks, regardless of height. This emphasises the need when assessing existing buildings with regards to the building regulations, for judgement, research and experience to be applied. Regulation 8 of the regulations places a limit on all requirements such that they “shall not require anything to be done except for the purposes of securing a reasonable standard of health and safety for persons in and about the building”.

The requirements for buildings depend on it’s “consequence class” as described in Table 11 of Part A of the building regulations 2010.

Class	Building type and occupancy	Summary requirements
1	• House not exceeding 4 storeys. • Agricultural buildings. • Buildings into which people rarely go.	• No additional measures are likely to be necessary.
2A	• 5 storey single-occupancy houses. • Hotels, apartments and other residential buildings not exceeding 4 storeys. • Offices not exceeding 4 storeys. • Industrial buildings not exceeding 3 storeys. • Retailing premises not exceeding 3 storeys of less than 2000 m^2 floor area in each storey. • Single-storey educational buildings. • All buildings not exceeding 2 storeys to which members of the pubic are admitted and which contain floor areas exceeding 2000 m^2 at each storey.	• Horizontal ties, OR • Effective anchorage of floors to walls, as described in the codes of practice.
2B	• Hotels, apartments and other residential buildings exceeding 4 storeys, but not exceeding 15 storeys. • Educational buildings greater than 1 storey, but not exceeding 15 storeys. • Retail premises greater than 3 storeys but not exceeding 15 storeys. • Hospitals not exceeding 3 storeys. • Offices greater than 4 storeys but not exceeding 15 storeys. • All buildings to which members of the pubic are admitted and which contain floor areas exceeding 2000 m^2 but less than 5000 m^2 at each storey. • Car parking not exceeding 6 storeys.	• Horizontal ties and vertical ties as described in the codes of practice, OR • Show that the removal of a wall or column will cause only limited damage, OR • Design as 'key elements'.
3	• All buildings defined above as Class 2A and 2B that exceed the limits on area and/or number of storeys. • All buildings, containing hazardous substances and/or processes. • Grandstands accommodating more than 5000 spectators.	• Systematic risk assessment.
Note Basement storeys may be excluded provided they meet Class 2B criteria		

Table 5: Building Type and Consequence Class

Boulton House is classified as a Class 2B building. There are effectively three approaches to determining compliance.

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

1. Compliance with tying rules
2. That the removal of a wall or column will cause only limited damage
3. Showing that "key elements" and "non-removable" – i.e. can withstand the accidental loading requirements discussed above.

It is very complex to accurately model the behaviour of a building under explosive loadings but recognised techniques, combined with engineering judgment enable a reasonable assessment to be made. In this case, the form of construction predates mandated robustness requirements and relies on the tying between floors and beams which are inherent to this form of construction. In principle, if any column/wall were to be removed then the inherent capacity of the slabs would distribute the loads to effectively bridge the area affected. Therefore the removal of any such member would not result in anything more than that a localised collapse allowed in the code. However, extensive intrusive investigations and a detailed analysis would be required to confirm compliance.

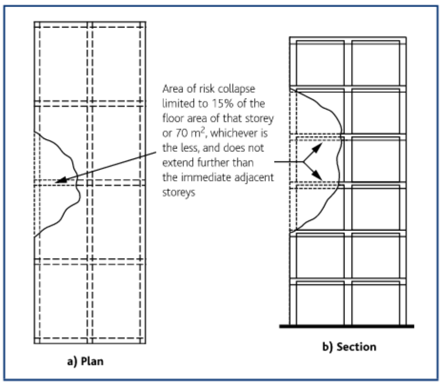


Figure 8: Requirements for Limited Damage approach

5 Site Inspection

The inspection took place on 05/06/25 and the findings have been recorded in this report. The scope of the inspection included limited, visual observations of the interior and exterior of the structure and was viewed from ground level. The report contains a limited amount of photographs taken during the inspection.

5.1 External Walls Elevations

The exterior elevations were generally in ok condition and no significant structural defects were noted to the infill panels. There were no significant cracks or tell-tale signs of any significant structural movement noted at the time of our inspection.

The original external wall system is constructed as a cavity wall, with a stretcher bond leaf of masonry to the outer leaf supported off an exposed slab edge and a blockwork leaf internally. We were unable to see within the wall cavity to confirm whether there are ties or masonry supports present.

The exterior panels were noted to be plumb with no signs of significant bowing, bulging or leaning noted to the panels indicating failed fixings however their presence and condition cannot be confirmed.

There are balconies at each level which are formed of cantilevered RC slabs tied into the main frame. The balconies would benefit from a refurbishment with widespread failed coatings throughout. The cantilevered slabs should be checked for internal corrosion potential at the benchmark inspections.

Figure 9 and 10: Building Elevations

5.2 Roof

The flat roof structure is a reinforced concrete cast slab. There is an enclosure which partially covers the roof area which covers the access stairs. Antenna have been installed to the roof of the enclosure.

There were no tell-tale signs of any significant structural movement noted at the time of our inspection.

The roof has a felted waterproofing system. The exact build-up of the roof finishes were not accessible at the time of inspection. It is recommended an intrusive survey of the roof finishes is completed by a specialist surveyor to assess the condition of the roof covering although they were noted in good condition with no known water ingress issues and therefore a low risk element.


Figure 11 and 12: Roof Level

5.3 Typical Floor Plan

The stair core and landing areas of every level were inspected with more detailed assessments made at third points over the height of the building. Refer to Appendix A for site records.

The floors in the communal landings were noted to be solid concrete floors. The floors were checked with a spirit level and were considered level and within tolerance. The doors and windows to the communal landings from the stair core all appeared to be level and opened and closed without difficulty. There were no signs of structural movement detected.

There were vertical concrete walls supporting the floor plates at every level. The elements visible matched the floor layout in Figure 6. The walls appear continuous from ground to roof with no transfer structure. The overall condition of the structure observed is good.

The minimum required thickness of the floor slabs to achieve the prescribed fire resistance of 90 minutes, as specified in Appendix A of CP114 and shown in Figure 13, is met. To confirm the as built resistance of the concrete sections in the event of a fire a cover check of the reinforcement is required.

TABLE 27. FIRE RESISTANCE OF REINFORCED CONCRETE FLOORS

Construction and materials	Minimum total thickness of concrete, in millimetres, for a period of:					
	4 h	3 h	2 h	1½ h	1 h	½ h
Solid slab construction and floors of precast channel or T-section	150	150	125	125	100	95
Precast or in-situ inverted U-sections where the minimum thickness occurs only at the crowns	150	150	100	100	75	65
Hollow-block construction and precast units of box or I-section.	125	100	90	90	75	65

NOTE 1. For all types of floor, the concrete cover to the main reinforcement should not be less than 25 mm for the 4-hour grading nor less than 15 mm for the lower gradings.
NOTE 2. The total thickness may include that of the screed and/or tile, where used.

Figure 13: Appendix A of CP114 – Fire Resistance

The interior of the stair core walls were checked and were plumb and in line with observations made to the exterior – no significant signs of leaning or movement noted. The concrete appeared in fair condition with few BRE category 1 cracks but no structurally significant defects were noted.

The stair stringer was noted to be 120mm thick which seems short of modern standards. A cover test is required to check the resistance of the concrete section in the event of a fire.

Figure 14 and 15: Slab edge and stair stringer


Figure 16 and 17: RC internal elements

5.4 Summary Key Elements

To assist in compiling the Building Safety Case Report a summary table of the key structural elements which may be included as suggested in the Building Safety Act 2022 has been compiled with highlighted cells indicating areas of missing information which require further investigations.

ELEMENT	FINDING
PRIMARY MATERIAL OF CONSTRUCTION	• Reinforced Concrete – Intrusive investigations required
TYPE OF BUILDING	• Concrete Frame
PRIMARY LOAD BEARING SYSTEM	• Cast Concrete Floors on RC Frame
STABILITY SYSTEM	• Shear Walls
CLADDING SUPPORT SYSTEM AND FIXINGS	• Cavity Walls
ROOFING MATERIALS	• Flat RC Slab
FOUNDATIONS	• Presumed Piled System but unknown
BALCONIES	• Every level cast concrete
OTHER OVERHANG STRUCTURES	• NA

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

BUILDING CONSEQUENCE CLASS	• Class 2B as per Part A of Building Regulations

Table 6: Key Structural Element Summary

Refer to Appendix A for detailed photographic record of the salient structural elements recorded.

6 Structural Risk Assessment

In line with government guidance one of the objectives of the Higher-Risk Building ("HRB") safety regime is to identify the building's safety risks and describe how they being managed.

The risks included are for structural failure. For the purpose of this report the HAZID technique has been adopted. This is an analysis of the hazards that may impact structural safety of the property, and is included in the Appendix B.

The HAZIDs considered are:

- Gas Explosion
- Fire within a building
- Minor material deterioration
- Sever Material Deterioration
- Water ingress from roof or damaged pipes
- Poor construction / design inadequacies
- Underground leakage / flooding causing foundation settlement
- Vehicle impact
- Unauthorised Structural Alterations
- Accidental Aircraft Impact

Each risk associated to a hazard is the combination of:

• the probability of an incident (how likely is it to happen?)

• the severity of an incident (what the consequences could be?)

Severity may be categorised as: low, Localised damage (1) medium, localised failure leading to risk of life/serious injury (2) high, Significant collapse or potential progressive collapse (3)

Probability may be categorised as unlikely (1) probable (2) or certain (3).

The risk is multiplied with the consequence and use a 3x3 matrix to categorise the risks, refer to table under. Recommended mitigation measures are included to either maintain existing control measures or, if possible, adding to them. Suggested timeframes for carrying out the recommendations are added to each item which should form part of the building Action Plan.

Consequence

Unit 3,
Endeavour House,
Longbridge Road,
PL6 8LR

		Localised Damage	Isolated local failure - Life threatening or serious injury possible	Significant failure leading to major catastrophic event. Life threatening or serious injury possible to multiple people
Likelihood	High	3	6	9
	Medium	2	4	6
	Low	1	2	3

Categorisation of Risk using 3x3 Matrix

Green = Tolerable risk

Yellow = Medium risk to be managed and if reasonable mitigated

Red = Intolerable Risk to be mitigated ASAP

7 Conclusions and Recommendations

The findings of this report are that the existing structure is generally sound and appeared to be in a fair condition for its age. There were no tell-tale signs of any significant structural movement or cracks which fall in the BRE Category 3 or above.

Although we expect cavity construction with internal block tied to an external leaf of brickwork it is not possible to confirm without further investigations by a specialist surveyor. There are no signs the wall ties have failed however it is impossible to determine their presence and condition without further investigations by a specialist who can use a metal detector and endoscope.

To effectively manage the risks we suggest completing the actions from the risk assessment included in Appendix B.

There are no signs of ground movement across the footprint of the building therefore although we can only assume the piled foundation type we do not deem it a pressing matter to perform the intrusive and costly trial pits which would be required to confirm their presence. These should be included in the scope at the next major structural intervention works to the building.

Due to the age of the building it is wise to perform periodical health checks to the concrete elements. This should include tests for concrete strength, cover depth, carbonation, chlorides and HAC. It would appear that these tests have never been performed to this building and therefore we recommend engaging a specialist contractor within the next 24 months who will be able to perform the tests and provide an interpretive report.

We expect a fire resistance of the structure to be minimum 1.5 hours however this can't be confirmed without a cover test to RC frame

As part of the structural safety risk management for the building an inspection regime which includes a combination of superficial , regular and benchmark investigations should be implemented. These are described as follows:

Superficial Inspection: Personnel visiting the structure and noting visible indications of potential durability issues. The building manager to have an adequate system for keeping up to date with structural changes to the building and an engagement strategy in place for residents to raise concerns.

Regular inspections: The building is to be surveyed at regular 5 year intervals by a competent engineer to inspect for signs of movement, structural decay and/or defects.

Benchmark Inspections which will include durability intrusive investigations: Every 15-20 years, when there is a functional change, or when a regular inspection notes a particular issue, whichever comes first.

Unit 3,
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PL6 8LR

Appendix A – Structural Elements Survey

4a Darklake View
Plymouth
PL6 7TL

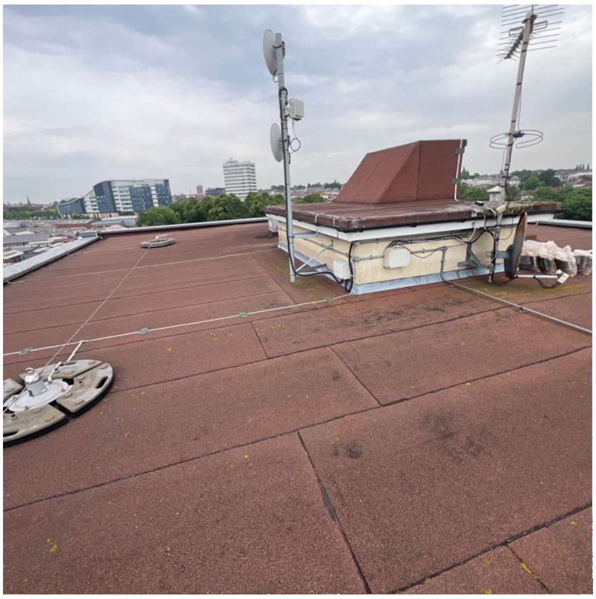
Boulton House

Firntec
12 Jun 2025

Project Details

Name: Boulton House

Main Roof



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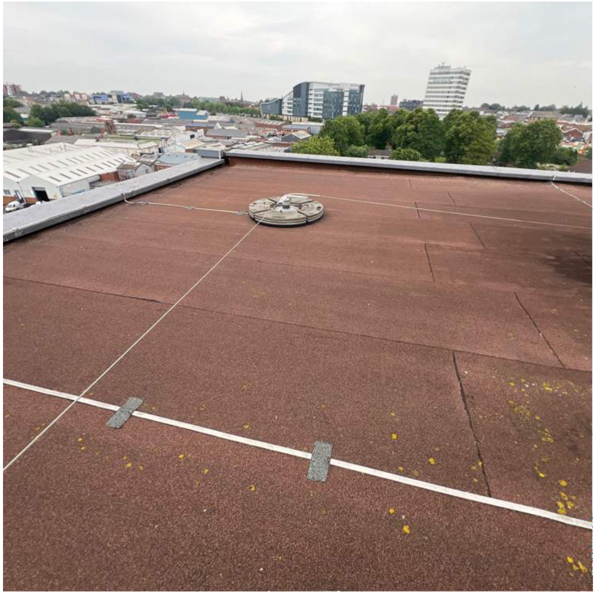
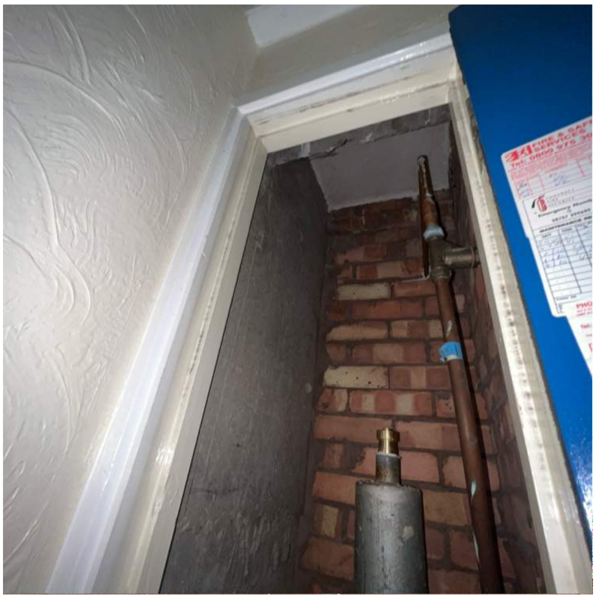
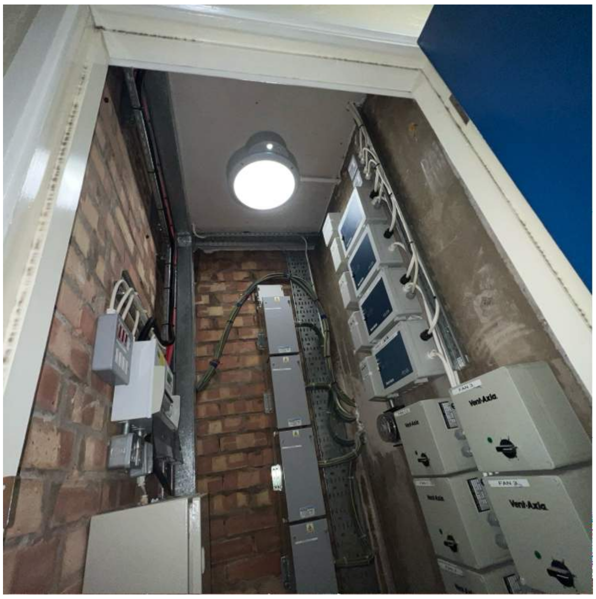
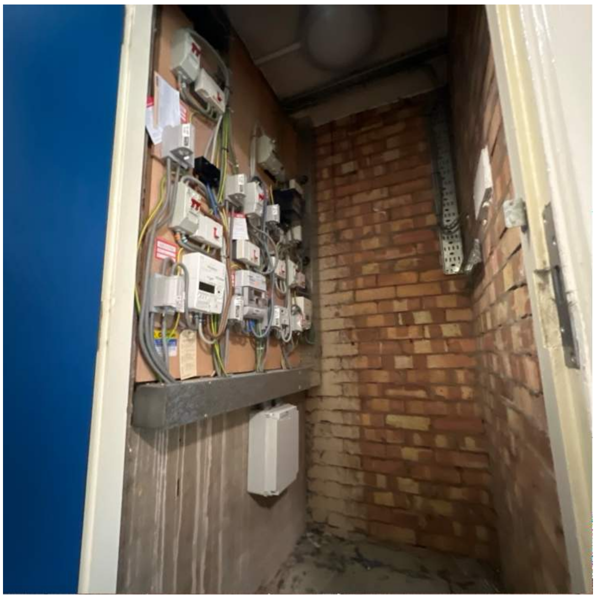


Comments: Flat roof, RC concrete slab with insulated PIR board and felt coverings.

8th Floor Hallway

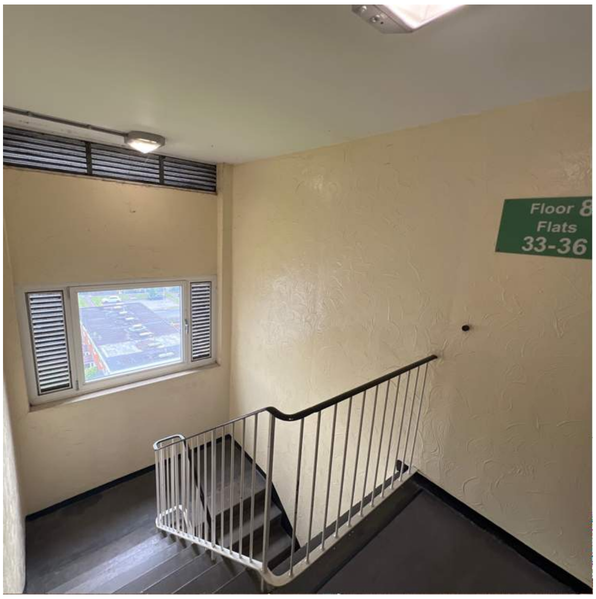


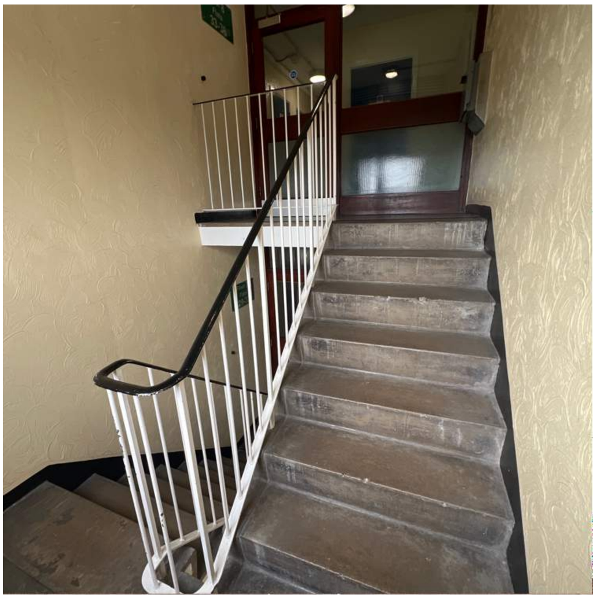


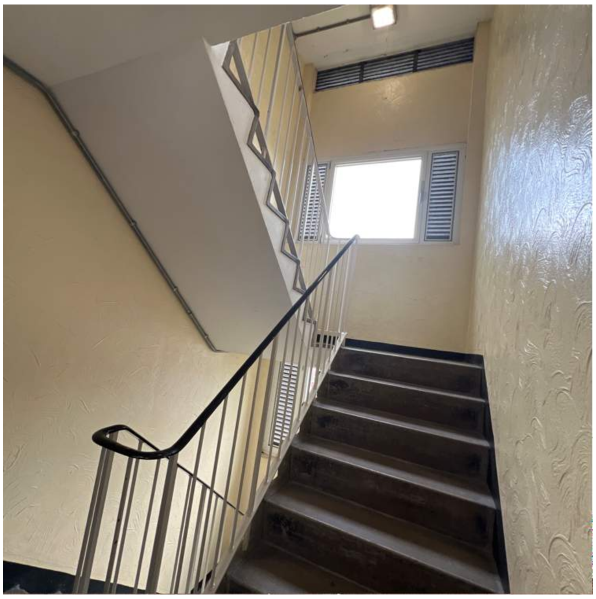


Comments: No jams or distortions noted to hallway doors to indicate any serviceability issues. Generally walls covered with finishes in hallway, likely to consist a mixture of concrete shear walls, embedded columns and masonry infill walls. Limited structure exposed. Concrete walls and infill masonry (non-load bearing) walls noted in riser cupboards.

8th Floor Staircases







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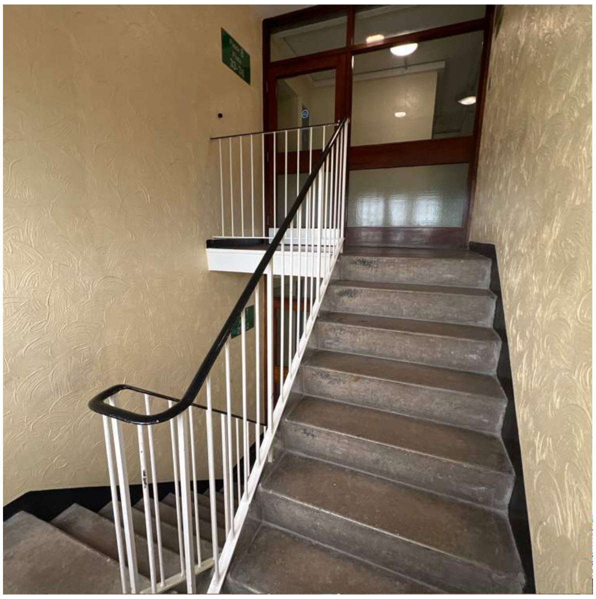
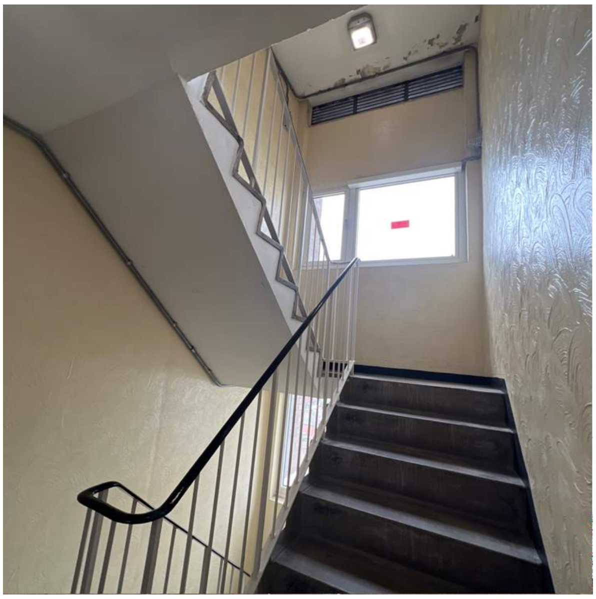
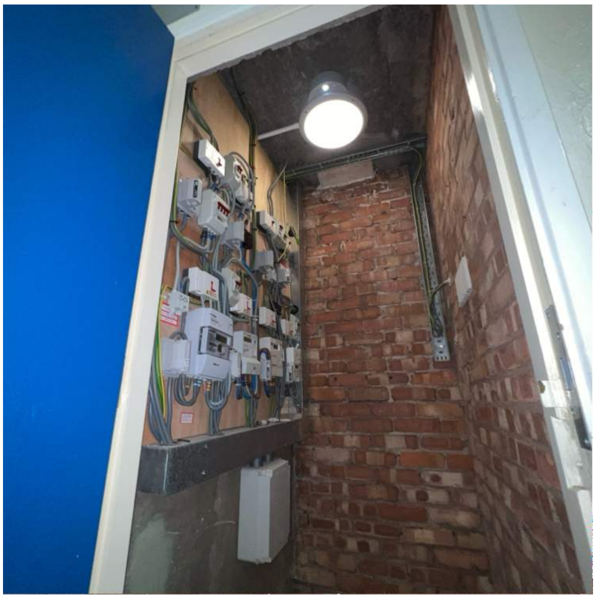
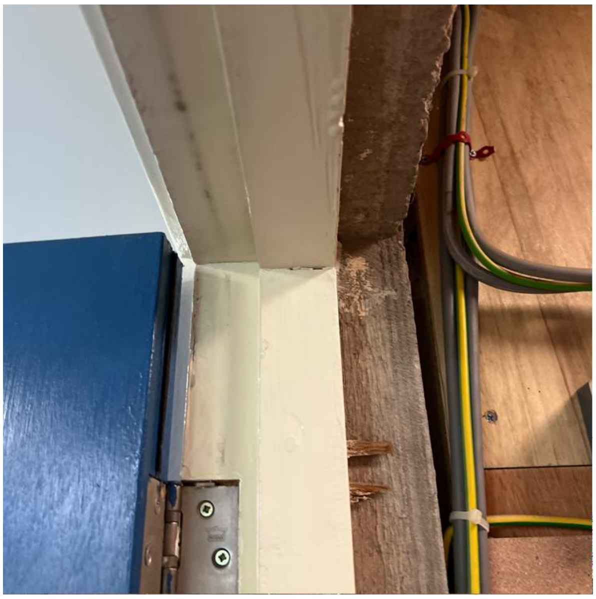




Comments: Insitu concrete stairs with steel hand railing fixed to stairs. Walls and floors appear to be faily level.
Stair walls covered with finishes however these would likely form the main concrete shear core walls.

5th Floor Hallway





Comments: No jams or distortions noted to hallway doors to indicate any serviceability issues. Generally walls covered with finishes in hallway, likely to consist a mixture of concrete shear walls, embedded columns and masonry infill walls. Limited structure exposed. Concrete walls and infill masonry (non-load bearing) walls noted in riser cupboards.

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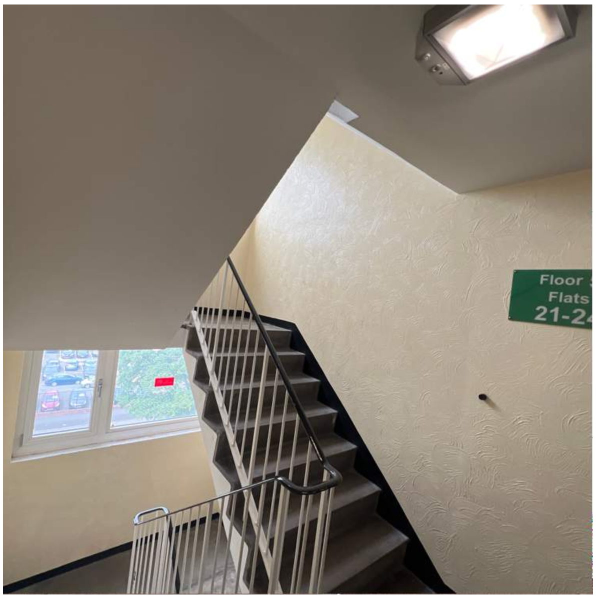
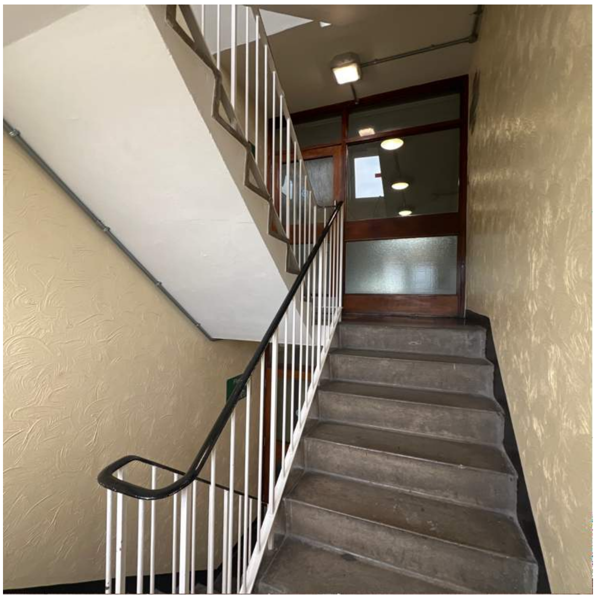
5th Floor Staircases





Comments: Insitu concrete stairs with steel hand railing fixed to stairs. Walls and floors appear to be faily level.
Stair walls covered with finishes however these would likely form the main concrete shear core walls.

Ground Floor Hallway

Comments: No jams or distortions noted to hallway doors to indicate any serviceability issues. Generally walls covered with finishes in hallway, likely to consist a mixture of concrete shear walls, embedded columns and masonry infill walls. Limited structure exposed. Concrete walls and infill masonry (non-load bearing) walls noted in riser cupboards.

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Bin Store

Comments: RC concrete walls noted in bin store.

Elevations




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Comments: External facade consists of brick work on all levels for all elevations. Cantilevered balconies noted at each floor.

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Unit 3,
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Appendix B – HAZID Risk Assessment

Item	Scenario	Hazard	Consequence	Existing Controls	Original Risk			Mitigation Measures	Residual Risk			Recommended Action	Timeframe
					Probability	Severity	Rating		Probability	Severity	Rating		
1	Gas Explosion	Structural failure to columns/walls	Partial or total collapse if the impacted element is a key element	Robustness relies on the tying between floors and columns which are inherent to the form of construction. In principle, if a column was removed the inherent stiffness of the slab would transfer the load to adjacent vertical structure, forming only a localised collapse	2	2	4	Gas pipework and services are regularly checked a managed. Ensure storage contraints are applied, such as banning gas cannisters.	1	2	2	Client to confirm gas safety checks in place and take measures to ensure gas storage requirements are known to residents.	3 months
2	Fire within a building	Significant damage to a structural element due to loss of load bearing capacity	Single member experiences plastic deformation causing structural collapse	Concrete elements have an inherent fire resistance. The prescribed fire resistance at the time of construction (CP114) would have required 90 minutes however this relies on the cover to the reinforcement.	2	1	2	Cover checks in representative locations of the strcuture with section analysis to ensure prescribed fire resistance is met.	2	1	2	Cover meter tests to determine structural fire resistance of frame and floor build-up confirmation. Fire Risk Appraisals are carried out regularly as per fire engineers recommendations.	Ongoing
3	Minor Material Deterioration	Spalling elements cause cover to burst. Cavity wall ties corrode causing loss of section	Damage to areas/people below spalled element. Outer leaf cladding to bulge/deform/crack	Concrete elements have been designed for a prescribed design life and exposure class with sufficient cover to reinforcement steel.	3	1	3	Perform visual structural surveys on a regular basis to inspect critical signs of deterioation.	1	1	1	An inspection regime which includes a combination of superficial , regular and benchmark investigations should be implemented. As per BRE Digest 444.	Ongoing
4	Severe Material Deterioration	Damage to a structural element causes a loss of load bearing capacity	Single member experiences plastic deformation causing structural collapse	Concrete elements have been designed for a prescribed design life and exposure class with sufficient cover to reinforcement steel.	2	3	6	Concrete durability material tests for strength, carbonation, presence of chlorides and HAC.	1	3	3	An inspection regime which includes benchmark investigations with durability testing to RC frame should be implemented. As per BRE Digest 444.	Every 15 years. Therefore due in the next 18-24 months
5	Water ingress from roof or damaged pipes	Damage to structural elements from exposure to water causes RC elements to spall	Damage to areas/people below spalled element	Concrete elements have some inherent protection from localised short term water ingress provided by the concrete cover.	2	1	2	Perform visual structural surveys on a regular basis to inspect for signs of water ingress. Resident engagement stratgey for reporting signs of damp and leaking pipes	2	1	2	An inspection regime which includes regular visual imspections by a competent person. Implement an adequate resident engagement strategy for reporting leaks / dampness	6 months
6	Poor construction / design inadequacies	Significant damage to a structural element due to insufficient load bearing capacity	Single member experiences plastic deformation causing structural collapse	Building was constructed when British Standard Code of Practice 114 1957 for structural use of reinforced concrete was in place	1	3	3	Structural inspections to RC frame which can provide confidence on the quality of design and workmanship	1	1	1	Spot cover checks and concrete strength tests to RC frame	12 months
7	Underground leakage / Flooding	Corrosion to soils under foundations causing subsidence. Altered exposure class to concrete elements expediates deteriation (refer to item 6)	Building suffers differential settlement	Building may subside due to differential settlements across the footprint of the building causing damage to finishes and services	2	2	4	Underground drainage survey and regular 5 year visual surveys to inspect for movement	1	2	2	An inspection regime which includes regular visual imspections by a competent person. Complete an underground drainage survey for drains adjacent to properties	Regular 5 years or sooner

8	Vehicle Impact	Structural failure to columns/walls which are subject to impact	Partial or total collapse if the impacted element is a key element	Buliding is set back from public road with fencing in between road and elevation but exposed to parking. Robustness relies on the tying between floors and columns, if a column was removed the inherent stiffness of the beam over would transfer the load to adjacent vertical structure, forming only a localised collapse	1	2	2	Consider installing bollards between buildnig elevation and car park	1	2	2	None	
9	Unauthorised Structural Alterations	The load path within the structure changes	Single member is overloaded and experiences plastic deformation causing structural collapse	Building manager permission is required when renovating units within the building. If a column was overloaded to failure the inherent stiffness of the slab would transfer the load to adjacent vertical structure, forming only a localised collapse	3	2	6	Ensure that the residents are aware of the conseuquences of unauthorised alterations. Work applications are to be reviewed by a competent structural engineer	3	1	3	PAP to put up notices within the building lobby notifyinh residents of dangers of unauthorised alterations.	6 months
10	Accidental Aircraft Impact	Structural failure to columns/walls which are subject to impact	Partial or total collapse if the impacted element is a key element	Robustness relies on the tying between floors and columns, if a column was removed the inherent stiffness of the slab would transfer the load to adjacent vertical structure, forming only a localised collapse	1	3	3	The risk of aircraft impact is improbable and therefore overall risk is considered as low as reasonably possible wihtout further mitigation measures required.	1	3	3	None	

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